

CLAIMS:

1. A method of making an insulating glass (IG) window unit, the method comprising:

providing a glass substrate;
forming a layer comprising diamond-like carbon (DLC) on the glass substrate;
forming a protective layer on the glass substrate over the layer comprising DLC;

heat treating the glass substrate with the layer comprising DLC and the protective layer thereon so that during the heat treating the protective layer prevents significant burnoff of the layer comprising DLC, wherein the heat treating comprises heating the glass substrate to temperature(s) sufficient for thermal tempering; and

after the heat treating, coupling the glass substrate with at least the layer comprising DLC thereon to another substrate in making the IG window unit.

2. The method of claim 1, wherein the layer comprising DLC is formed on the glass substrate via an ion beam.

3. The method of claim 2, wherein the protective layer is at least partially formed on the glass substrate via sputtering.

4. The method of claim 1, further comprising sputtering a solar control multi-layer coating onto a surface of the glass substrate so that the solar control coating and the layer comprising DLC are formed on opposite sides of the glass substrate.

5. The method of claim 4, wherein the solar control coating comprises at least first and second dielectric layers, and an infrared (IR) reflecting layer comprising one of Ag and NiCr provided between the dielectric layers.

6. The method of claim 1, further comprising removing at least part of the protective layer from the glass substrate after the heat treating but before the coupling of the glass substrate to the another substrate.

7. The method of claim 1, wherein the heat treating is part of a thermal tempering process in which the glass substrate is thermally tempered.

8. The method of claim 1, wherein the protective layer comprises amorphous silicon (a-Si).

9. The method of claim 1, wherein the protective layer comprises at least one carbide.

10. The method of claim 1, wherein the protective layer comprises at least one of: a-Si, silicon nitride, silicon oxide, silicon oxynitride, boron carbide, titanium carbide, hafnium carbide, titanium hafnium carbide, tantalum carbide, zirconium carbide, chromium, an alloy of nickel-chrome, an oxide of nickel-chrome, a nitride of nickel-chrome, titanium, and an oxide of titanium.

11. The method of claim 1, wherein the protective layer comprises at least one of: BC_x (boron carbide) where x is from 0.75 to 1.5, TiC_x (titanium carbide) where x is from 0.47 to 0.99, HfC_x (hafnium carbide) where x is from 0.47 to 0.99, titanium hafnium carbide, TaC_x (tantalum carbide) where x is from 0.47 to 0.99, and ZrC_x (zirconium carbide) where x is from 0.47 to 0.99.

12. The method of claim 1, wherein the heat treating comprises heating the glass substrate with the layer comprising DLC and the protective layer thereon using at least temperature(s) of at least 550 degrees C.

13. The method of claim 1, wherein the heat treating comprises heating the glass substrate with the layer comprising DLC and the protective layer thereon using at least temperature(s) of at least 580 degrees C.

14. The method of claim 1, wherein the layer comprising DLC comprises amorphous DLC and has more sp^3 carbon-carbon bonds than sp^2 carbon-carbon bonds.

15. The method of claim 14, wherein the layer comprising DLC has an average hardness of at least 10 GPa.

16. The method of claim 15, wherein the layer comprising DLC has an average hardness of at least 20 GPa.

17. The method of claim 1, wherein the layer comprising DLC has a density of at least about 2.7 gm/cm^3 , and wherein the layer comprising DLC is hydrogenated.

18. The method of claim 1, wherein the layer comprising DLC comprises hydrogenated highly tetrahedral amorphous carbon (ta-C:H).

19. A method of making a vehicle windshield, the method comprising:
providing a glass substrate;
forming a layer comprising diamond-like carbon (DLC) on the glass substrate;
forming a protective layer on the glass substrate over the layer comprising DLC;

heat treating the glass substrate with the layer comprising DLC and the protective layer thereon, wherein the heat treating comprises heating the glass substrate to temperature(s) sufficient for bending the glass substrate; and

after the heat treating, laminating the glass substrate with at least the layer comprising DLC thereon to another substrate via at least a polymer inclusive interlayer in making the vehicle windshield.

20. The method of claim 19, wherein the layer comprising DLC is formed on the glass substrate via an ion beam using a hydrocarbon gas.

21. The method of claim 19, wherein the protective layer is at least partially formed on the glass substrate via sputtering.

22. The method of claim 19, further comprising sputtering a solar control multi-layer coating including at least one layer of silver (Ag) onto a surface of the glass substrate so that the solar control coating and the layer comprising DLC are formed on opposite sides of the glass substrate.

23. The method of claim 22, wherein the solar control coating comprises at least first and second dielectric layers on opposite sides of the layer of Ag, but not in contact with the Ag.

24. The method of claim 19, further comprising removing at least part of the protective layer from the glass substrate after the heat treating but before the laminating.

25. The method of claim 19, wherein the protective layer comprises at least one carbide.

26. The method of claim 19, wherein the protective layer comprises at least one of: a-Si, silicon nitride, silicon oxide, silicon oxynitride, boron carbide, titanium carbide, hafnium carbide, titanium hafnium carbide, tantalum carbide, zirconium carbide, chromium, an alloy of nickel-chrome, an oxide of nickel-chrome, a nitride of nickel-chrome, titanium, and an oxide of titanium.

27. The method of claim 19, wherein the protective layer comprises at least one of: BC_x (boron carbide) where x is from 0.75 to 1.5, TiC_x (titanium carbide) where x is from 0.47 to 0.99, HfC_x (hafnium carbide) where x is from 0.47 to 0.99, titanium hafnium carbide, TaC_x (tantalum carbide) where x is from 0.47 to 0.99, and ZrC_x (zirconium carbide) where x is from 0.47 to 0.99.

28. The method of claim 19, wherein the heat treating comprises heating the glass substrate with the layer comprising DLC and the protective layer thereon using at least temperature(s) of at least 550 degrees C.

29. The method of claim 19, wherein the heat treating comprises heating the glass substrate with the layer comprising DLC and the protective layer thereon using at least temperature(s) of at least 580 degrees C.

30. The method of claim 19, wherein the layer comprising DLC comprises amorphous DLC and has more sp^3 carbon-carbon bonds than sp^2 carbon-carbon bonds.

31. The method of claim 30, wherein the layer comprising DLC has an average hardness of at least 10 GPa.

32. The method of claim 31, wherein the layer comprising DLC has an average hardness of at least 20 GPa.

33. The method of claim 19, wherein the layer comprising DLC has a density of at least about 2.7 gm/cm^3 , and wherein the layer comprising DLC is hydrogenated.

34. The method of claim 19, wherein the layer comprising DLC comprises hydrogenated highly tetrahedral amorphous carbon (ta-C:H).

35. The method of claim 19, wherein the layer comprising DLC is formed via an ion beam and carbon atoms thereof are subimplanted into the glass substrate.

36. A method of making a coated article, the method comprising:
providing a glass substrate;
forming a layer comprising diamond-like carbon (DLC) on the glass substrate;

forming a protective layer on the glass substrate over the layer comprising DLC;

heat treating the glass substrate with the layer comprising DLC and the protective layer thereon, and

wherein the heat treating comprises heating the glass substrate using at least temperature(s) of at least 580 degrees C, in an atmosphere including oxygen, for a time period sufficient for at least one of bending and thermally tempering the glass substrate.

37. The method of claim 36, wherein the layer comprising DLC is formed on the glass substrate via an ion beam, and wherein carbon atoms thereof are subimplanted into the glass substrate.

38. The method of claim 36, wherein the protective layer is at least partially formed on the glass substrate via sputtering.

39. The method of claim 36, wherein the coated article comprises either a vehicle window or an IG window unit.

40. The method of claim 36, further comprising sputtering a solar control multi-layer coating including at least one layer of silver (Ag) or nickel-chrome (NiCr) onto a surface of the glass substrate so that the solar control coating and the layer comprising DLC are formed on opposite sides of the glass substrate.

41. The method of claim 36, further comprising removing at least part of the protective layer from the glass substrate after the heat treating.

42. The method of claim 36, wherein the protective layer comprises at least one carbide.

43. The method of claim 36, wherein the protective layer comprises at least one of: a-Si, silicon nitride, silicon oxide, silicon oxynitride, boron carbide,

titanium carbide, hafnium carbide, titanium hafnium carbide, tantalum carbide, zirconium carbide, chromium, an alloy of nickel-chrome, an oxide of nickel-chrome, a nitride of nickel-chrome, titanium, and an oxide of titanium.

44. The method of claim 36, wherein the protective layer comprises at least one of: BC_x (boron carbide) where x is from 0.75 to 1.5, TiC_x (titanium carbide) where x is from 0.47 to 0.99, HfC_x (hafnium carbide) where x is from 0.47 to 0.99, titanium hafnium carbide, TaC_x (tantalum carbide) where x is from 0.47 to 0.99, and ZrC_x (zirconium carbide) where x is from 0.47 to 0.99.

45. The method of claim 36, wherein the layer comprising DLC comprises amorphous DLC and has more sp^3 carbon-carbon bonds than sp^2 carbon-carbon bonds.

46. The method of claim 36, wherein the layer comprising DLC has an average hardness of at least 10 GPa.

47. A coated article comprising:
a glass substrate that is thermally tempered and/or bent;
a layer comprising diamond-like carbon (DLC) supported by the glass substrate; and
a protective layer comprising a carbide provided on the glass substrate over the layer comprising DLC.

48. The coated article of claim 47, wherein the DLC comprises hydrogenated highly tetrahedral amorphous carbon (ta-C:H).

49. The coated article of claim 47, wherein the layer comprising DLC comprises amorphous DLC, has more sp^3 carbon-carbon bonds than sp^2 carbon-carbon bonds, and has an average hardness of at least 10 GPa.

50. The coated article of claim 47, wherein the carbide comprises at least one of: boron carbide, titanium carbide, hafnium carbide, titanium hafnium carbide, tantalum carbide, and zirconium carbide.

51. The coated article of claim 47, wherein the carbide comprises at least one of: BC_x (boron carbide) where x is from 0.75 to 1.5, TiC_x (titanium carbide) where x is from 0.47 to 0.99, HfC_x (hafnium carbide) where x is from 0.47 to 0.99, titanium hafnium carbide, TaC_x (tantalum carbide) where x is from 0.47 to 0.99, and ZrC_x (zirconium carbide) where x is from 0.47 to 0.99.

52. The coated article of claim 47, wherein the protective layer comprising the carbide is from about 5 to 50 Å thick.

53. The coated article of claim 47, wherein the protective layer comprising the carbide is from about 5 to 20 Å thick.

54. The coated article of claim 47, wherein at least some carbon atoms of the DLC are subimplanted into the glass substrate.